WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Proposal for Phase II of a Cooperative University of Kansas/Kansas State University Project

Submitted to the Kansas Water Resources Institute

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Project Category: Information/Communication

Project Duration: One year (1 March 2000 to 28 February 2001)

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Keywords: Water resources, Information systems, World Wide Web, Collaboration

Abstract

The proposed effort will continue to develop a "virtual institute" by using available technology and Internet (WWW) capabilities to create interactive links among the interested institutions, agencies, and individuals. Phase I of the project established an "office complex, communications center and information center". The Phase I construction can be visited at http://falcon.cc.ukans.edu/~mgirmay/kwihome.htm This is a temporary site while under construction; during November 1999 the permanent "test bed" site will migrate to http://www.kgs.ukans.edu/KWRC/kwinew/. This site will be password-protected during the developmental stages (prior to March 1, 2000) to permit review and experimental linkages. When this transition occurs, reviewers may obtain the password information from Girmay Misgna or Geoffrey Duncan. In Phase II, we plan to

establish electronic conferencing, electronic instruction, and smart systems that include data manipulation and scenario testing.

The KWI will address the critical problem of assembling the necessary expertise to formulate, and provide holistic solutions to, the multidisciplinary problems relating to water resources in Kansas. It will do so by augmenting the capabilities of existing institutions, and especially by facilitating effective collaborations among organizations and individuals.

Although the electronic institute draws heavily on existing websites and the concepts underlying them, it will transcend the typically passive "many-to-one" relationships of individuals seeking stand-alone sites to sample available information or find other links. The unique contributions of our virtual institute will consist of (1) structuring both new and existing sites into a multi-site network with thematic links and search capabilities, (2) adding a wide range of communication and exchange capabilities, at least some of which can be invoked and designed by users, and providing smart systems through simulation models.

The combination of dynamic interactions and prompt feedback on needs and effectiveness will greatly improve the communications among -- and ultimately, cooperation and collaboration between -- such diverse but mutually dependent groups as natural and social scientists, managers, and policy makers. In achieving this objective, the virtual institute will also create an unparalleled tool for improved education and public information.

The work will be carried out by web designers employed under the supervision of the Principal and Cooperating Investigators. Based on input from reviewers and consultation among the PIs, this Phase II submission reflects a commitment to expand and maintain this innovative website.

The Virtual Kansas Water Resources Institute: Proposed Technical Plan

Statement of the Problem

Water resources -- their quality, quantity, location, and social and economic importance -- are recognized as major issues now and for the future. Water resource issues extend beyond topics conventionally defined as such, into much broader environmental and resource areas such as Global Change and Biodiversity, in Kansas and the world.

Within Kansas, water has been so important for so long that every educational, research, and regulatory or policy agency has water-oriented components and programs. Through the Water Plan and the Kansas Water Office, the state has acted to coordinate, and sometimes integrate, the activities of the various management, regulatory, and policy agencies. Increasingly, this coordination has resulted in recognition that water-related problems are complex and multi-disciplinary in nature, requiring holistic solutions.

Kansas has great resources in the areas of water-related science (both natural and social) and technology, but they are not organized to address the kind of holistic demands that are now put upon them. Water-related programs are compartmentalized, both between and within institutions, and integration is largely left to the initiative of individuals. This proposal addresses a means by which integration can be greatly enhanced and encouraged, in a rapid and economical fashion.

Proposed Work

The recent advances in development of electronic communication, and information and data exchange technologies, has provided us, in principle, with everything from teleconferencing and e-mail to highly sophisticated WWW pages (and linkages) and high-speed data networks. We propose to integrate these capabilities into our Virtual Kansas Water Resources Institute that:

1) links the relevant people and programs of all of the states research, information, and water-management agencies,

2) shares and develops data, expertise, and syllabi,

3) effectively delivers public information and enhances education, and 4) perhaps most importantly, provides existing institutions with an organizational basis for the kind of collaborative, holistic research that is essential in dealing with the rapidly growing, complex water problems at all levels from local to global.

This is an area of rapid development; similar activities are being undertaken elsewhere in the US, and examples already exist in Europe (W. Hargrove, pers. comm.). There is no lack of models or proven components -- the unique contribution described in this proposal involves both institutional and individual collaboration in the development of an interactive water science network of expertise and information.

Related Products and Activities

Although others are pursuing similar goals (W. Hargrove, pers. comm.), there are no existing examples of a virtual institute analog. However, the institutions represented in this proposal represent a wide range of web-based applications and expertise as well as general strength computer science applications (e.g., the Great Plains high speed data network, and the new supercomputer at KU).

The Kansas Geological Survey (KGS -- R. W. Buddemeier, PI), with its contract support of the Data Access and Support Center (DASC), has extensive experience in providing on-line and off-line geoscience data and information (KGS WWW sites currently consist of over 15,000 pages of energy, natural resource, and public outreach material; see: http://www.kgs.ukans.edu/Dakota/vol1/dakotaHome.html; http://magellan.kgs.ukans.edu/WaterLevels/index.html; http://gisdasc.kgs.ukans.edu/). The PI of this proposal (R. W. Buddemeier) is also project manager for the High Plains

Aquifer Evaluation Project, a multi-agency effort that will provide a natural test bed for prototype development in both the communication and information aspects of the proposed KWI.

Kansas State University Research and Extension (J. K. Koelliker, Head, Department of Biological and Agricultural Engineering, co-PI) brings not only scientific expertise in the areas of water use, demand, managed ecosystems, and microenvironmental processes, but is also a leader in the development of WWW-based >distance learning relevant to water issues (http://www.dce.ksu.edu/dce/distance/waterquality/).

The Kansas Biological Survey (KBS: http://www.gemlab.ukans.edu/kbs/) and the Kansas Applied Remote Sensing Program (KARS: http://www.kars.ukans.edu/) (Edward A. Martinko, Director, co-PI) provide expertise in ecosystem studies and aquatic biology in KBS; KARS is a NASA Regional Applications Center, and has pioneered the presentation of near-real-time satellite data interpreted as vegetation indices (http://www.kars.ukans.edu/greenlab/index.html).

We can also identify other Kansas-relevant information sources for linking -- for example, USGS (Kansas surface hydrology and stream flow: http://www-ks.cr.usgs.gov/) and the Corps of Engineers (Kansas reservoir data: http://www.swt-wc.usace.army.mil/).

In terms of models, a variety of sites have some of the characteristics similar to those which will be incorporated into the KWI. E.g., http://www.conservancy.com/ is a clean, user-friendly basic information site. Http://www.ce.utexas.edu/prof/maidment/ is a site that provides not only a wide range of data and information, but also a glimpse of the electronic communication future in science and engineering -- however, it would be more useful if equipped with indices and a search engine. The EPA site http://www.epa.gov/surf2/ illustrates high-tech web use with feedback and communication links -- but substantive content is weak. By copying the strengths and avoiding the mistakes and limitations of others, we expect to progress rapidly in developing a uniquely effective multilateral, interactive network.

Methods and Procedures

The conceptual approach to developing the virtual KWRI may be analogized to a physical institute with a lobby, office complex, communications center, information center (library), computing center, instructional center, and conference center. We plan to have all of these elements in our virtual institute. This is presented diagrammatically in Fig. 1. In Phase I, we focused on the lobby, office complex, information center, and communications center. At present, you may visit the construction site at: http:falcon.cc.ukans.edu/~mgirmay/kwihome.htm. During November 1999 the permanent "test bed" site will migrate to http://www.kgs.ukans.edu/KWRC/kwinew/. This site will be password-protected during the developmental stages (prior to March 1, 2000) to permit review and experimental linkages. When this transition occurs, reviewers may obtain the password information from Girmay Misgna (gmisgna@kgs.ukans.edu) or Geoffrey Duncan (lusis@bae.ksu.edu). In Phase II, we will focus on the computing

center, instructional center, and conference center. We are also attempting to network and crosslink elements within the centers and across centers, analogous to a Geographic Information System (GIS) overlay analysis, in which a series of related but independent two-dimensional images are registered, "stacked," and then linked and analyzed across their "three-dimensional" combinations. The results, whether considered in two or three dimensions, are fundamentally new and more advanced than anything derived from the individual components -- the novelty and the value added originates in the connections and combinations. The virtual KWRI will be an electronic "water network" that takes the same fundamental approach and elaborates it further, free of the constraints imposed by the need for physical juxtaposition of people, objects, and facilities. Some of the layers that have been assembled and integrated through various "centers" are discussed below. In PhaseII, we will continue to refine and build on these.

The Office Complex

1. People, expertise, and interests (the office complex) -- a multi-parameter, flexibly searchable directory of the information and expertise represented by the community of researchers, managers, planners, and other interested parties. These people -- who are both the basic resource of, and one of the target audiences for, the network -- are all operationally defined "Fellows of the Virtual Institute." The components of this network should all be existing and self-sustaining: the home pages and web-based facilities of the various institutions, programs, and individuals. The role of the project in developing this network will be linking existing resources, working with participants to improve the information content and ease of access of their own pages.

2. Institutions, Organizations, and Programs -- Similar to item 1, a linked network of local, state, and federal agencies, teaching and/or research institutions, NGOs and interest groups, etc. As with the "people" network, this network will be largely pre-existing and sustained by the participating institutions, and the role of the project will be to augment, connect, and place the components into context. These networks will not be single-purpose or narrowly problem-oriented, however; there will be important spinoff values from this effort, for example:

a. Effective presentations not only of individual institutions, but of the broader community and resource context in which they operate, should enhance effectiveness in soliciting funding, recruiting staff, students, etc.

b. Easy visualization of the range of education and training opportunities available in the area of water-related issues should lead to increased innovation in filling in gaps within the state offerings, and (especially in conjunction with distance learning), would make it possible for individual institutions to emphasize and develop their unique strengths, while drawing on other institutions to maintain diversity and background material necessary for their program offerings.

The Information Center

1. Resources, problems, and issues -- a broad, explanatory overview of the major water-related issues facing Kansas, their significance and implications, and the factors affecting them (social and economic as well as natural science). This will be the major intellectual synthesis associated with the project; it will be assembled by the PIs working closely with the KWRRI advisory committee, it will draw heavily on Kansas Water Office formulations of needs augmented by assessments of national and regional bodies, and it will make the maximum feasible use of links to existing sites. The completion of this particular product-- or even its complete conceptualization -- is NOT a prerequisite for progress on the other components; much of the work will be done in parallel.

2. Information and data access -- This network would integrate a wide variety of links to other sites (e.g., regional and national data sources are particularly important for weather and climate information), access to on-line and off-line (Wizard, DASC) data sources, searchable bibliographies, etc., all keyed to the "problem" areas and issues identified in item 1. As with items 2 and 3, the core material accessed through this network would be largely pre-existing and self-sustaining, although specific developments would be solicited or encouraged by the project. This, along with updates of item 1, will be the component of the established network that will require the most effort to keep current in an ongoing program.

Centers to be Developed in Phase II

In Phase II, we will add the following components to the Virtual Institute.

<u>Conference Center</u>. We plan to add a conference center that will accommodate electronic conferencing and chat rooms.

<u>Data Processing Center</u>. We plan to add a data processing center that will be able to access, process, and manipulate data to make such calculations as a daily water balance for a crop, test management scenarios through simulation models, etc. This will require data access and coupling of simulation models. The technical input and personnel needs in order to implement this aspect of the center are considerably greater than for the other elements. Thus, though we might initiate this center with at least one computing module, it will continue to grow in the future.

<u>Instructional Center</u>. We plan to add an instructional center where courses for university credit can be accessed as well as continuing education materials and shortcourses on water resources issues and protection. Kansas State University has developed a suite of three web-based courses for credit in the area of water resources: Water Management and Irrigation Systems (Spring, 99); Water Resources and Hydrology (Fall, 99); and Water and Waste Environemnt (Fall, 99). We will need other member institutions to offer courses to make the instructional center viable.

Phase III: Pilot Testing

We will also conduct a pilot testing during the coming year to test the functionality of the new centers. We will conduct an electronic conference, pilot test the computing center, and conduct a shortcourse in the instructional center by the end of the grant period (Feb, 2001).

Development Strategy, Time Schedule, and Management Plan

Objective -- A self-sustaining operation by January, 2001.

Basis for long-term maintenance -- The Virtual KWRI system will be at once highly advantageous to, and generally beyond the individual capabilities of, the participating organizations. Once the system is put in place and its effectiveness demonstrated, enlightened self-interest should be the incentive for continued participation and support. During the lifetime of the proposed project, it is envisioned that coordination through the KWRI and informal project advisory committees will develop the appropriate multi-institutional basis for basic infrastructure support and maintenance for the ongoing KWRI enterprise.

Development plan -- The additional work will span the calendar year 2000, with follow-on evaluation and fine-tuning into the beginning of CY 2001. This spans two state Fiscal years and one additional KWRI funding cycle, permitting progressive development of management and intermediate and long-term funding. We plan to "unveil" the Virtual KWRI at the 2000 Water and the Future of Kansas Conference.

Management and Advisory Groups and Levels -- (1) Principal Investigator; (2) All Investigators; (3) The KWRI Administrative Council. We plan to have a review/comment period in early 2000 to get feedback from stakeholders.

Tentative Schedule –

Jan-Mar 2000: Consultation, review, by KWRI Administrative Council; revise and refine. Mar, 2000 Unveiled at the Water and Future of Kansas Conference; open to stakeholder review and comment.

March-April, 2000 Revision, refinement

May-Dec, 2000 - Construction of additional centers (conference, computing, instructional)

Jan-Feb, 2001 - Review and comment from Administrative Council and Stakeholders

Phase III

Mar-May 2001: Pilot testing of interactive centers; first electonic conference, electronic course, and interactive computing pilot.

May-June, 2001 Clean-up and finalization of the electronic KWI and of plans for maintenance and further development; documentation and reporting.

July 2001 Transition to ongoing management and technical support arrangements.

Information transfer and educational potential

The proposed products are intrinsically information transfer and educational systems (see especially items 3b and 4 under "Methods and Procedures"). They will be brought on line, refined, and made available in a progressive fashion -- prototypes will be selectively tested on and reviewed by the active participants and stakeholders, then made available to wider audiences. At each step, some non-electronic means will be needed to augment web-based recruitment and information dissemination. These may be letters and phone calls at the initial contact stage, seminars or workshops to enhance agency-level or institutional use and feedback, and other pathways to stimulate interest in the public-access components. The advisory committee(s) will play a key role in determining, and assisting with, appropriate information transfer.

Anticipated results and benefits

The primary result expected is the development of the "virtual" KWRI, as described above. The benefits of this will be enhanced understanding of, and communication about, Kansas water issues and needs at all levels, and rapid, inexpensive ways to bring the needed expertise to bear on problems without needless duplication of effort or the disruption of existing programs and institutions. If fully successful, Kansas will become a leader in the revolutionary revision of the way society uses available technology to address environmental and resource problems.